the volume is entitled coordination, and contains chapters on Thallophytes and Schizophytes, Myxomycetes and fungi, algae, lichens, and a final chapter on immunity among plants. It is an elementary treatise, written in entertaining and lucid style. That the author has been dead ten years accounts for the appearance of occasional remarks which do not quite reflect our latest knowledge, as for instance, that "the formula for the constitution of chlorophyll is not known." Beginners, either in botany or French, would find it a delightful little volume.—C. A. SHULL.

MINOR NOTICES

Flora of Natal.—BEWS,[3] well known for his ecological study of the vegetation of Natal, has published a taxonomic account of the flora "for the purpose of assisting the study of plant ecology and botanical survey work in Natal." The introduction contains a very interesting account of the history of botany in Natal, from the earliest collector (1832) to the present time. The analytical keys are remarkably simple, leading to the genera, but the species are merely listed, with their ecological range and often with their local Zulu names. The author states that "the flowering plants of Natal, as now arranged, belong to 148 families, and include 901 genera and 3786 species."—J. M. C.

Osmotic pressure.—The publication of a new edition of Pfeffer's[4] famous work on osmotic pressure will be welcomed by students of plant physiology and physical chemistry who have desired to own a copy of this classic work. No changes have been made from the first edition, except that an introductory appreciation of PFEFFER'S work by CZAPEK precedes the text.—C. A. SHULL.

NOTES FOR STUDENTS

Specificity of chromosomes and sex-determination.—For a final proof of the rôle of the individual chromosome we must look to the remarkable investigations of BRIDGES.[5] It was this author who furnished a direct demonstration of the chromosome theory of heredity, when he showed that irregular distributions of the sex chromosomes of *Drosophila* were accompanied by irregularities in the inheritance of known sex-linked factors. He now[6] provides a similar demonstration of the specificity of the autosomes, and at the

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[3] BEWS, J. W., The flora of Natal and Zululand. pp. vi+248. Pietermaritzburg. 1921. 15*s*. (Whelden and Wesley, 28 Essex St., Strand, London).

[4] PFEFFER, W., Osmotische Untersuchungen. pp. xiv+236. *figs*. 5. Leipzig: Engelmann. 1921.

[5] BRIDGES, C. B., Non-disjunction as proof of the chromosome theory of heredity. Genetics 1:1–52. 1916.

[6] ———, Triploid intersexes in *Drosophila melanogaster*. Science 54:252–254. 1921.

same time adds a very significant and far-reaching modification of present ideas on sex determination.

An unexpected distribution in inheritance of known factors which are located on the second and third chromosomes of *Drosophila* was explainable on the assumption that the female parent of the cross was a triploid with respect to these chromosomes. Cytological examination proved that this was actually the case. This same group of flies also exhibited some remarkable irregularities in their sex condition. A considerable group of "intersexes" occurred, as evidenced by the secondary sex characters and the condition of the gonads as well. This was apparently a bimodal group, some of the intersexes being of a more "female type" and others of a more "male type." Cytological examination of these individuals revealed that the second and third chromosomes were regularly present in a triploid condition, that the fourth chromosome was either diploid or triploid, and that two *x*-chromosomes were regularly present (with or without a *y*-chromosome). The situation is interpreted as follows. "It is not the simple possession of two *x*-chromosomes that makes a female, or of one that makes a male. A preponderance of genes that are in the autosomes tends toward the production of male characters; and the net effect of genes in the *x* is a tendency to the production of female characters. The ratio of *2x:2 sets autosomes* produces a female, while *1x:2 sets autosomes* produces a male. An intermediate ratio, *2x:3 sets autosomes*, produces an intermediate condition, the intersex. The fourth chromosome seems to have a disproportionately large share of the total male-producing genes; for there are indications that the triplo-fourth intersexes are preponderantly of the 'male type', while the diplo-fourth intersexes are mainly 'female type.'" According to this conception, *3x:2 sets autosomes* should be "superfemales," and *1x:3 sets autosomes* "supermales." The author has actually identified such types, both being sterile.

It is certain that this conception will exert a far-reaching influence upon the existing ideas of sex-determination. In the first place, it gives a somewhat more exact idea as to the elements effective in determining sex. Hitherto it has been thought, rather vaguely, that the *x*-chromosome determines sex either per se or by virtue of some special factor which it contains. It is interesting to realize that a number of factors may be influencing sex in one direction or the other, and perhaps that these are identical with factors which have previously been known as playing another rôle. A different rate of metabolism has commonly been associated with the two sexes; a study of the influence of specific factors on metabolic rate now becomes significant in this connection. In the second place, it furnishes an exact interpretation of intersexes on a chromosome basis. Hitherto intersexes have either been interpreted in very vague terms, or have been used as an argument against the chromosome theory of sex determination, or have been harmonized with the sex chromosome theory only by the assumption of some additional extrachromosomal influence (GOLDSCHMIDT). The present conception paints a quantitative picture of sex

without calling upon any other effective elements than the "orthodox" factors of inheritance that are located on the chromosomes. In the third place, the theoretical possibility of artificially controlling sex is illuminated. Such control should be possible to the degree that the ordinary heritable characters can be successfully duplicated artificially. The fact that the fourth chromosome (which is known to contain relatively few factors) is preponderant in its influence toward maleness suggests that a few specific factors may be preponderant in influence. Artificial control, therefore, should necessitate the duplication of the effects of only a few of the factors. Also, the identification of particularly effective heritable factors should be followed by the establishment of a race with a heritably distorted sex ratio.—M. C. COULTER.

Taxonomic notes.—BØRGESEN,[7] in continuation of his studies of the marine algae of the Danish West Indies, has completed the Rhodophyceae. These two concluding parts include 101 species, four of which are new, distributed among 29 genera. The following three new genera are established: *Cottoniella*, *Coelothrix*, and *Hypneocolax*. An extensive appendix (86 pp.) gives a list of the Chlorophyceae, Phaeophyceae, and Rhodophyceae found at the islands, together with addenda and corrections.

ENGLER[8] and his collaborators, in continuation of their studies of the African flora, have published the following results: ULBRICH describes 4 new species of *Pavonia;* MEZ describes 94 new species of grasses, 33 in *Panicum*, 33 in *Melinis*, and 18 in *Digitaria;* ENGLER describes 16 new species of Gesneraceae, 14 of which are in *Streptocarpus*, and also establishes a new genus (*Ctenocladus*) of Moraceae; WOLFF describes 19 new species of Umbelliferae and establishes *Caucaliopsis* as a new genus; KRAUSE describes 8 new species of Liliaceae; IRMSCHER describes 7 new species of Begoniaceae; and BITTER, in continuation of his monograph of African *Solanum*, has reached 56 species.

RYDBERG[9], in continuation of his work on the Rosaceae, has presented the roses of the Columbia region, which includes Oregon and Washington, together with British Columbia and northern Idaho. In this region he recognizes 37 species of *Rosa* and nine hybrids.

SCHLECHTER,[10] in reorganizing the classification of *Spiranthes*, recognizes 35 species of *Spiranthes* and establishes 16 new genera as follows, chiefly from Mexico, the West Indies, and South America: *Galeottiella*, *Hapalorchis*,

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[7] BØRGESEN, F., The marine algae of the Danish West Indies. Rhodophyceae (5 and 6). Dansk Botanisk Arkiv **3**: 305–498. *figs. 308–435.* 1919 and 1920.

[8] ENGLER, A., Beiträge zur Flora von Afrika. XLVIII. Bot. Jahrb. **75**: 161–301. 1921.

[9] RYDBERG, PER AXEL, Notes on Rosaceae. XIII. Bull. Torr Bot. Club **48**: 159–172. 1921.

[10] SCHLECHTER, R., Versuch einer systematischen Neuordnung der Spiranthinae. Beih. Bot. Centralbl. **37**: 317–454. 1920.